

CLAIMS

1. An electrostatic attraction fluid jet device which ejects a fluid, which is electrified by a voltage application, by an electrostatic attraction in the form of a droplet from a fluid-ejecting hole of a nozzle made of an insulating material, wherein

a diameter of the fluid-ejecting hole of the nozzle is equal to or less than $\Phi 8 \mu\text{m}$.

2. The electrostatic attraction fluid jet device as set forth in claim 1, comprising

an applied voltage control means which controls a voltage applied to the fluid so as to adjust the amount of the droplet ejected from the fluid-ejecting hole,

the applied voltage control means controlling the voltage applied to the fluid so that the amount of the droplet, which has just been ejected from the fluid-ejecting hole, of the fluid is equal to or less than 1 pl.

3. The electrostatic attraction fluid jet device as set forth in claim 1, wherein the diameter of the fluid-ejecting hole of the nozzle is not less than $\Phi 0.2 \mu\text{m}$ and not more than $\Phi 4 \mu\text{m}$.

4. The electrostatic attraction fluid jet device as set

forth in claim 2, wherein the applied voltage control means controls a voltage applied to the fluid so that a diameter of the droplet, which has just been ejected from the fluid-ejecting hole, is not less than 1.5 times and not more than 3 times longer than the diameter of the fluid-ejecting hole.

5. The electrostatic attraction fluid jet device as set forth in claim 2, wherein the applied voltage control means controls a voltage applied to the fluid so that a diameter of the droplet, which has just been ejected from the fluid-ejecting hole, is not less than 1.5 times and not more than twice longer than the diameter of the fluid-ejecting hole.

6. An electrostatic attraction fluid jet device which ejects a fluid, which is electrified by a voltage application, by an electrostatic attraction in the form of a droplet from a fluid-ejecting hole of a nozzle made of an insulating material, wherein

a diameter of the fluid-ejecting hole of the nozzle is equal to or less than a diameter of the droplet, which has just been ejected, of the fluid.

7. The electrostatic attraction fluid jet device as set

forth in claim 6, comprising

an applied voltage control means which controls a voltage applied to the fluid so as to adjust the amount of the droplet ejected from the fluid-ejecting hole,

the applied voltage control means controlling the voltage applied to the fluid so that the amount of the droplet, which has just been ejected from the fluid-ejecting hole, of the fluid is equal to or less than 1 pl.

8. The electrostatic attraction fluid jet device as set forth in claim 6, wherein the diameter of the fluid-ejecting hole of the nozzle is not less than $\Phi 0.2 \mu\text{m}$ and not more than $\Phi 4 \mu\text{m}$.

9. The electrostatic attraction fluid jet device as set forth in claim 7, wherein the applied voltage control means controls a voltage applied to the fluid so that a diameter of the droplet, which has just been ejected from the fluid-ejecting hole, is not less than 1.5 times and not more than 3 times longer than the diameter of the fluid-ejecting hole.

10. The electrostatic attraction fluid jet device as set forth in claim 2, wherein the applied voltage control means controls a voltage applied to the fluid so that a diameter of

the droplet, which has just been ejected from the fluid-ejecting hole, is not less than 1.5 times and not more than twice longer than the diameter of the fluid-ejecting hole.

11. An electrostatic attraction fluid jet device which ejects a fluid, which is electrified by a voltage application, by an electrostatic attraction in the form of a droplet from a fluid-ejecting hole of a nozzle made of an insulating material, comprising:

an applied voltage control means which controls a voltage applied to the fluid in the nozzle,

wherein,

a diameter of the fluid-ejecting hole of the nozzle is equal to or less than $\Phi 8 \mu\text{m}$, and

the applied voltage control means controls a voltage applied to the fluid so that the amount of electric charge, induced to the droplet of the fluid which droplet has just been ejected from the fluid-ejecting hole, is equal to or less than 90 % of the amount of electric charge corresponding to Rayleigh limit of the droplet.

12. The electrostatic attraction fluid jet device as set forth in claim 11, wherein the applied voltage control means controls a voltage applied to the fluid so that the

amount of electric charge, induced to the droplet of the fluid, the droplet having just been ejected from the fluid-ejecting hole, is equal to or less than 60 % of the amount of electric charge corresponding to Rayleigh limit of the droplet.

13. The electrostatic attraction fluid jet device as set forth in claim 11, wherein the diameter of the fluid-ejecting hole of the nozzle is equal to or less than $\Phi 5 \mu\text{m}$.

14. The electrostatic attraction fluid jet device as set forth in claim 11, wherein the diameter of the fluid-ejecting hole of the nozzle is not less than $\Phi 0.2 \mu\text{m}$ and not more than $\Phi 4 \mu\text{m}$.

15. An electrostatic attraction fluid jet device which ejects a fluid, which is electrified by a voltage application, by an electrostatic attraction in the form of a droplet from a fluid-ejecting hole of a nozzle made of an insulating material, comprising:

an applied voltage control means which controls a voltage applied to the fluid in the nozzle,

wherein

a diameter of the fluid-ejecting hole of the nozzle is equal to or less than a diameter of the droplet, which has

just been ejected, of the fluid, and

the applied voltage control means controls a voltage applied to a fluid so that the amount of electric charge, induced to a droplet of the fluid which droplet has just been ejected from the fluid-ejecting hole, is equal to or less than the amount of electric charge corresponding to Rayleigh limit of the droplet which has just been ejected by an electric field whose intensity is maximum at the meniscus.

16. The electrostatic attraction fluid jet device as set forth in claim 15, wherein the applied voltage control means controls a voltage applied to a fluid so that the amount of electric charge, induced to a droplet of the fluid which droplet has just been ejected from the fluid-ejecting hole, is equal to or 0.8 times as much as the amount of electric charge corresponding to Rayleigh limit of the droplet which has just been ejected by an electric field whose intensity is maximum at a meniscus of the fluid.

17. The electrostatic attraction fluid jet device as set forth in claim 15, wherein the diameter of the fluid-ejecting hole of the nozzle is equal to or less than $\Phi 5 \mu\text{m}$.

18. The electrostatic attraction fluid jet device as set forth in claim 15, wherein the diameter of the fluid-ejecting

hole of the nozzle is not less than $\Phi 0.2 \mu\text{m}$ and not more than $\Phi 4 \mu\text{m}$.

19. An electrostatic attraction fluid jet device which ejects a fluid, which is electrified by a voltage application, on a printing medium with a speed corresponding to an applied voltage, the fluid being ejected in the form of a droplet by an electrostatic attraction from a fluid-ejecting hole of a nozzle made of an insulating material, comprising:

an applied voltage control means which controls a voltage applied to the fluid in the nozzle,

wherein

a diameter of the fluid-ejecting hole of the nozzle is equal to or less than $\Phi 8 \mu\text{m}$, and

the applied voltage control means controls a voltage applied to the fluid so that an average velocity of the fluid, which is ejected and lands on a printing medium, is not less than 10 m/s and not more than 40 m/s.

20. The electrostatic attraction fluid jet device as set forth in claim 19, wherein the diameter of the fluid-ejecting hole of the nozzle is equal to or less than $\Phi 5 \mu\text{m}$.

21. The electrostatic attraction fluid jet device as set forth in claim 19, wherein the diameter of the fluid-ejecting

hole of the nozzle is not less than $\Phi 0.2 \mu\text{m}$ and not more than $\Phi 4 \mu\text{m}$.

22. An electrostatic attraction fluid jet device which ejects a fluid, which is electrified by a voltage application, on a printing medium with a speed corresponding to an applied voltage, the fluid being ejected in the form of a droplet by an electrostatic attraction from a fluid-ejecting hole of a nozzle made of an insulating material, comprising:

an applied voltage control means which controls a voltage applied to the fluid in the nozzle,

wherein

a diameter of the fluid-ejecting hole of the nozzle is equal to or less than a diameter of the droplet, which has just been ejected, of the fluid, and

the applied voltage control means controls a voltage applied to the fluid so that an average velocity of the fluid, which is ejected and lands on a printing medium, is not less than 10 m/s and not more than 40 m/s.

23. The electrostatic attraction fluid jet device as set forth in claim 22, wherein the diameter of the fluid-ejecting hole of the nozzle is equal to or less than $\Phi 5 \mu\text{m}$.

24. The electrostatic attraction fluid jet device as set

forth in claim 22, wherein the diameter of the fluid-ejecting hole of the nozzle is not less than $\Phi 0.2 \mu\text{m}$ and not more than $\Phi 4 \mu\text{m}$.

25. An electrostatic attraction fluid jet device which ejects a fluid, which contains fine particles and is electrified by a voltage application, by an electrostatic attraction in the form of a droplet from a fluid-ejecting hole of a nozzle made of an insulating material, wherein

a diameter of the fluid-ejecting hole of the nozzle is equal to or less than $\Phi 8 \mu\text{m}$, and

a particle diameter of each of the fine particles contained in the fluid is equal to or less than $\Phi 30 \text{ nm}$.

26. The electrostatic attraction fluid jet device as set forth in claim 25, wherein the particle diameter of each of the fine particles contained in the fluid is not less than $\Phi 1 \text{ nm}$ and not more than $\Phi 10 \text{ nm}$.

27. The electrostatic attraction fluid jet device as set forth in claim 25, wherein the diameter of the fluid-ejecting hole of the nozzle is not less than $\Phi 0.2 \mu\text{m}$ and not more than $\Phi 4 \mu\text{m}$.

28. An electrostatic attraction fluid jet device which

ejects a fluid, which contains fine particles and is electrified by a voltage application, by an electrostatic attraction in the form of a droplet from a fluid-ejecting hole of a nozzle made of an insulating material, wherein

a diameter of the fluid-ejecting hole of the nozzle is equal to or less than a diameter of the droplet, which has just been ejected, of the fluid, and

a particle diameter of each of the fine particles contained in the fluid is equal to or less than $\Phi 30$ nm.

29. The electrostatic attraction fluid jet device as set forth in claim 28, wherein the particle diameter of each of the fine particles contained in the fluid is not less than $\Phi 1$ nm and not more than $\Phi 10$ nm.

30. The electrostatic attraction fluid jet device as set forth in claim 28, wherein the diameter of the fluid-ejecting hole of the nozzle is not less than $\Phi 0.2$ μm and not more than $\Phi 4$ μm .

31. An electrostatic attraction fluid jet device which ejects a fluid, which is electrified by a voltage application, by an electrostatic attraction in the form of a droplet from a fluid-ejecting hole of a nozzle made of an insulating material,

in the electrostatic attraction fluid jet device, a diameter of the fluid-ejecting hole of the nozzle being equal to or less than a diameter of the droplet, which has just been ejected, of the fluid,

the electrostatic attraction fluid jet device comprising:

an electrode for applying a voltage to the fluid; and

a process control section for controlling a voltage applied to the electrode so as to adjust the amount of a droplet ejected from the fluid-ejecting hole,

the process control section controlling a voltage applied to the electrode so that the amount of a droplet, which has just been ejected from the fluid-ejecting hole, of the fluid is less than 1 pl.

32. An electrostatic attraction fluid jet device which ejects a fluid, which is electrified by a voltage application, by an electrostatic attraction in the form of a droplet from a fluid-ejecting hole of a nozzle made of an insulating material,

in the electrostatic attraction fluid jet device, a diameter of the fluid-ejecting hole of the nozzle being equal to or less than $\Phi 8 \mu\text{m}$,

the electrostatic attraction fluid jet device comprising:

an electrode for applying a voltage to the fluid; and
a process control section for controlling a voltage applied to the electrode so as to adjust the amount of a droplet ejected from the fluid-ejecting hole,

the process control section controlling a voltage applied to the electrode so that the amount of a droplet, which has just been ejected from the fluid-ejecting hole, of the fluid is less than 1 pl.

33. An electrostatic attraction fluid jet device which ejects a fluid, which is electrified by a voltage application, by an electrostatic attraction in the form of a droplet from a fluid-ejecting hole of a nozzle made of an insulating material,

in the electrostatic attraction fluid jet device, a diameter of the fluid-ejecting hole of the nozzle being equal to or less than $\Phi 8 \mu\text{m}$,

the electrostatic attraction fluid jet device comprising:

an electrode for applying a voltage to the fluid; and
a process control section for controlling a voltage applied to the electrode so as to adjust the amount of a droplet ejected from the fluid-ejecting hole,

the process control section controlling a voltage applied to the electrode so that the amount of electric

charge, induced to a droplet of the fluid which droplet has just been ejected from the fluid-ejecting hole, is equal to or less than 90 % of the amount of electric charge corresponding to Rayleigh limit of the droplet.

34. An electrostatic attraction fluid jet device which ejects a fluid, which is electrified by a voltage application, by an electrostatic attraction in the form of a droplet from a fluid-ejecting hole of a nozzle made of an insulating material,

in the electrostatic attraction fluid jet device, a diameter of the fluid-ejecting hole of the nozzle being equal to or less than a diameter of the droplet, which has just been ejected, of the fluid,

the electrostatic attraction fluid jet device comprising:

an electrode for applying a voltage to the fluid; and

a process control section for controlling a voltage applied to the electrode so as to adjust the amount of a droplet ejected from the fluid-ejecting hole,

the process control section controlling a voltage applied to the electrode so that the amount of electric charge, induced to a droplet of the fluid which droplet has just been ejected from the fluid-ejecting hole, is equal to or less than the amount of electric charge corresponding to

Rayleigh limit of the droplet which has just been ejected by an electric field whose intensity is maximum at the meniscus.

35. An electrostatic attraction fluid jet device which ejects a fluid, which is electrified by a voltage application, on a printing medium with a speed corresponding to an applied voltage, the fluid being ejected in the form of a droplet by an electrostatic attraction from a fluid-ejecting hole of a nozzle made of an insulating material,

in the electrostatic attraction fluid jet device, a diameter of the fluid-ejecting hole of the nozzle being equal to or less than $\Phi 8 \mu\text{m}$,

the electrostatic attraction fluid jet device comprising:

an electrode for applying a voltage to the fluid; and

a process control section for controlling a voltage applied to the electrode so as to adjust the amount of a droplet ejected from the fluid-ejecting hole,

the process control section controlling a voltage applied to the electrode so that an average velocity of the fluid, which is ejected and lands on a printing medium, is not less than 10 m/s and not more than 40 m/s.

36. An electrostatic attraction fluid jet device which

ejects a fluid, which is electrified by a voltage application, on a printing medium with a speed corresponding to an applied voltage, the fluid being ejected in the form of a droplet by an electrostatic attraction from a fluid-ejecting hole of a nozzle made of an insulating material,

in the electrostatic attraction fluid jet device, a diameter of the fluid-ejecting hole of the nozzle being equal to or less than a diameter of the droplet, which has just been ejected, of the fluid,

the electrostatic attraction fluid jet device comprising:

an electrode for applying a voltage to the fluid; and

a process control section for controlling a voltage applied to the electrode so as to adjust the amount of a droplet ejected from the fluid-ejecting hole,

the process control section controlling a voltage applied to the electrode so that an average velocity of the fluid, which is ejected and lands on a printing medium, is not less than 10 m/s and not more than 40 m/s.

37. An electrostatic attraction ink jet device which ejects ink, which is electrified by a voltage application, by an electrostatic attraction in the form of a droplet from an ink-ejecting hole of a nozzle made of an insulating material, wherein

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a diameter of the ink-ejecting hole of the nozzle is equal to or less than a diameter of the droplet of the ink which has just been ejected.